

Amendments to the Drawings:

Examiner approval of the attached formal drawing, identified with the label "Replacement Sheet," to replace German wording with English is respectfully requested.

REMARKS

Claims 25-48 were examined in the Office Action mailed April 9, 2007, while claims 49-56 stand withdrawn pursuant to Election/Restriction Requirement. The Applicant notes with appreciation the indication that claim 47 recites patentable subject matter. For the reasons discussed below, the Applicant believes claim 47 depends from an allowable independent claim, and therefore respectfully declines the invitation to amend claim 47 into independent form at this time.

The following objections and rejections are currently pending:

- Objection to Fig. 1 for German text.
- Objection to the form of the Abstract.
- Objection to the claim 26 for an antecedent basis issue.
- Rejections under 35 U.S.C. § 103(a):
 - Claims 25, 27-29, 34, 36-44 and 48 as unpatentable over German Patent Publication No. DE 36 00 813 A1 ("Hundhausen") in view of U.S. Patent No. 6,303,891 to Gault ("Gault").
 - Claims 26 and 45 as unpatentable over Hundhausen and Gault, further in view of U.S. Patent No. 5,124,527 to Takano ("Takano").
 - Claim 30 as unpatentable over Hundhausen and Gault, further in view of U.S. Patent No. 5,558,791 to Fawer ("Fawer").
 - Claims 31-33 as unpatentable over Hundhausen and Gault, further in view of U.S. Patent No. 4,463,243 to Church ("Church").
 - Claim 35 as unpatentable over Hundhausen and Gault, further in view of U.S. Patent No. 4,645,903 to DeVito, *et al.* ("DeVito").
 - Claim 46 as unpatentable over Hundhausen and Gault, further in view of U.S. Patent No. 3,778,891 to Bishel ("Bishel").

1. The Drawing Objection Has Been Addressed. The Applicant has attached for Examiner review and approval a proposed drawing change to replace the German text in Fig. 1 with the corresponding English text. Approval of the requested change and withdrawal of the pending drawing objection is respectfully requested.

2. The Objection to the Abstract Has Been Addressed. The Applicant has amended the Abstract to address the issues identified by the Examiner. Withdrawal of the pending objection to the Abstract is respectfully requested.

3. The Objection to Claim 26 Has Been Addressed. In accordance with the Examiner's helpful suggestion, claim 26 has been amended to address the antecedent basis issue. Withdrawal of the objection to claim 26 is respectfully requested.

4. The Claims Are Patentable Over Hundhausen and Gault. The Applicant respectfully traverses the rejections under § 103(a) based on the Hundhausen and Gault references, on the ground that there is no teaching or suggestion for the combination of Gault with Hundhausen.

Independent claim 25 recites a method for arc welding with a consumable electrode under a protective gas, in which "a first part made of ductile cast iron and a second part made of ductile cast iron or steel" are joined by welding under a protective gas which contains "at least one of carbon dioxide in a range of 1 to 25 vol% and oxygen a range of 0.5 to 10 vol%, and the remaining volume of protective gas comprises one of argon and an argon-helium mixture."

As noted in the present Specification, “welding of ductile cast iron is possible in principle, but in practice there have been some major problems.” Specification ¶ [0005]. Where welding of common steels may be relatively easy, with suitable welds formed in the presence of a variety of process gases, “[w]elding of ductile cast iron requires special, highly complex welding techniques in order for the material to be weldable and for satisfactory results to be obtained.” *Id.* Unlike common steels, cast iron is characterized by very high carbon and silicon concentrations, and as a result the heating and cooling of cast iron must be highly controlled, in order to ensure that the excess carbon in the cast iron is made to come out of solution in a controlled manner to obtain the desired microstructure (and hence, material properties). *Id.* ¶ [0004]. Accordingly, “prolonged preheating and cooling procedures or heat treatments following the welding process are ... performed, but the heating and cooling rates must be kept very low to prevent cracks and stresses in the material. ... Because of these complex procedures, welding of ductile cast iron is possible only at a very low level of productivity and consequently is not used in production. Welding is used only for repairs and servicing of parts made of cast iron.” *Id.* ¶ [0005].

One factor in the management of heat and cooling rates is the make-up of the welding process gases, which must be carefully controlled to obtain desired heat transfer and chemical interaction characteristics. An object of the present invention is to provide a welding process in which cast iron may be welded with a consumable electrode with high productivity, contrary to prior experience with

cast iron welding. As noted in the Applicant's disclosure, it was surprisingly discovered that the use a protective gas containing carbon dioxide in a range of 1 to 25 vol% and/or oxygen up to a range of 0.5 to 10 vol%, with the remainder consisting of argon or an argon-helium mixture, "largely suppressed" "a change in structure and a negative effect on the properties of the ductile cast iron," with the resulting welded material having "almost stress-free welds." *Id.* ¶ [0009]. This unexpected benefit is attributed by the Applicant "to the fact that with the method according to this invention, the heat supply by the welding wire into the welding bath is controlled and the heat supply into the ductile cast iron material is controlled," and by control of heat input facilitated by the presence of carbon dioxide and oxygen, which are believed to "increase the heat input at the welding location and stabilize the arc." *Id.* These two factors are seen as cooperating in the particularly difficult context of cast iron welding to "suppress the development of pores," such that "[h]igh quality welds are formed." *Id.*

Against this disclosure of the well-known difficulties of welding cast iron to itself or to steels, claims 25 stands rejected based on the combination of a reference teaching welding of cast iron to steel in a mixture of argon, carbon dioxide and oxygen (Hundhausen), and a reference teaching a gas mixture for welding steels (Gault). April 9, 2007 Office Action at 4-5. It is asserted that it would have been obvious to combine these references, "in order to provide optimum welding conditions that will not alter the carbon content of the weld metal chemistry." *Id.* at 5-6 (citing Gault at 4:28-64, 5:8-12, 26:28 and 6:1-4).

The Applicant respectfully notes that while Gault may be directed to avoiding changes in carbon concentration in the weld metal of the steel weld, the present invention addresses other metallurgical issues which directly result from the heat problems that have historically made cast iron welding one of the most difficult forms of metal arc welding. Alternatively stated, because the heat distribution and transient heat flow in steel welding processes are fundamentally different from those in cast iron welding (due to the above-mentioned controlled carbon precipitation processes), one of ordinary skill in the art would not have considered the Gault steel welding process to be relevant to solving the problems in cast iron arc addressed by the invention recited in claim 25. Indeed, if Gault were combined with Hundhausen, the cited property of Gault (“not alter[ing] the carbon content of the weld metal”) would likely be a *detriment*, as the present invention’s approach to cast iron welding permits such changes, as necessary to achieve high quality welds. Thus, the recited motivation for combining Hundhausen and Gault is not a motivation to obtain the present invention.

In the absence of any suggestion or other reason to believe that one of skill in the art would have considered Gault’s steel welding process to be in any manner relevant to the very specialized problems of welding cast iron – let alone there being any reason to expect Gault’s steel-based process (processes historically known to be inapplicable to cast iron welding) would be successful in a cast iron welding application – the Applicant respectfully submits that one of

ordinary skill in the art would have had no suggestion or motivation to combine these references, and in any event would not have obtained the high quality cast iron welds provided by the present invention with a Hundhausen/Gault process.¹ Accordingly, claim 25 and its dependent claims 26-28 are patentable over these references under § 103(a). Reconsideration and withdrawal of the rejections based on Hundhausen and Gault is respectfully requested.

CONCLUSION

In view of the foregoing, the Applicants submit that claims 25-48 are in condition for allowance. Early and favorable consideration, and issuance of a Notice of Allowance for these claims is respectfully requested.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and

¹ The Applicant presumes that Gault was not cited merely because it contains a process gas that covers the claim 25 gas, as such a citation, without as a threshold consideration of the question of whether the nature of the welding process disclosed in Gault is applicable to cast iron material welding, would constitute impermissible hindsight reconstruction of the present invention, contrary to the requirements of the MPEP. *See, e.g.*, MPEP § 2145.X.A (hindsight reasoning permitted only “so long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time ... and does not include knowledge gleaned only from applicant’s disclosure”).

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Respectfully submitted,

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